



# Aircraft Performance

Accident investigations have discovered causal factors resulting from unreasonable expectations of aircraft performance – especially when operating at the edges of the aircraft weight and balance envelope. That’s why the Loss of Control Work Group suggests improvement in pilots’ understanding and calculation of aircraft performance.

When we speak of aircraft performance we’re usually answering three basic questions:

- How much can I haul?
- How far can I go?
- How long will it take me?

It sounds simple but a specific set of interdependent variables must be considered in order to answer each of these questions. Most of these variables have to do with aircraft performance, but the most important variable does not.

## Weight and Balance

A good way to plan a flight is to decide how much weight you want to haul to what destination. Start with the crew and passengers. Then add cargo. If these items alone exceed your aircraft’s capability, you’ll either have to make multiple trips, or get a bigger aircraft.

Once you know how much you want to haul, you can figure out how much fuel you can take, and that, together with your weather information, will tell you how far you can go. If you have enough to get to the destination plus alternate and reserve, you’re golden. If not, you’ll have to plan an en route fuel stop.

## Takeoff and Landing Distance

You’ll also have to consider your departure and arrival airports’ runway lengths, obstructions, and expected density altitude. If the field is short and/or obstructed you may not be able to safely fly with a full load. One more thing: Just because the book says the aircraft can do it doesn’t mean you can do it. Pilot skill and experience count for a lot when you’re trying to duplicate POH performance figures. Be conservative when you calculate your performance and consider adding a safety factor. Some pilots add 50% to their takeoff and landing calculations for safety.

Now we can figure all of this out by consulting the POH, right? Maybe not. There’s one more huge variable to consider and I bet you know what it is.

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## The Greatest Variable

So what's the greatest variable in all this? That's right – the pilot. Let's face it. The POH figures and all of our calculations don't mean much if we can't duplicate them in our flying. That's why it's important to document your performance capability at least yearly with a CFI. Fly at a typical mission weight and try to duplicate or simulate mission density altitudes. That way you'll know what you and your aircraft can (and can't) do.

In order to know what performance you and your flying machine are capable of you'll need to establish a baseline. Think of your baseline as an omnibus reference that relates pilot and aircraft performance under a given set of environmental circumstances on a given day.

Human factors such as fatigue and environmental factors such as higher density altitudes will result in performance below the baseline, while proficiency training and lighter loading will likely result in above baseline performance.

The key point to remember is that for any given flight you need to determine how you and your aircraft will perform. Your baseline is the foundation of that determination.

To establish your baseline, we suggest you load your aircraft with a typical mix of fuel, cargo, and passengers. (We recommend that one of those passengers be your CFI.) Calculate your test weight

My Short Field Performance			
Aircraft	Gross Weight		Test Weight
Airfield	Elevation		Density Alt.
Wind Direction	Wind Speed		X-Wind Comp
IAS	Landing Dist.		Flap Setting
Takeoff Flap	Rotation Speed		
Rotation Speed x.70		Vx	Vy
Distance to Rotation	Distance to 50'		

An example of a baseline calculation sheet

and note runway condition, elevation, density altitude, wind direction and speed.

Also note what rotation and climb speeds you intend to use and calculate 70 % of the rotation speed. More on that later.

Next you'll fly several takeoffs and landings noting your performance on each trial. When you're done you can average your performance figures and complete your baseline chart.

## Rules of Thumb for Takeoff Distance

- ⇒ Fixed pitch prop, add 15% to your calculated takeoff distance for each 1,000 foot increase in density altitude up to 8,000 feet/ 12% per 1,000 feet up to 6,000 feet for constant speed prop.
- ⇒ When planning takeoff from short unobstructed runways, establish a landmark at 50% of your calculated takeoff distance.
- ⇒ When on the takeoff roll you should have 70% of your rotation speed at that point. If you don't, the safest thing to do is to abort the takeoff.
- ⇒ If you can't meet the above requirement, reduce weight or wait for more favorable wind and temperature conditions.
- ⇒ If you must clear obstructions on takeoff, you'll need to have 70% of your rotation speed by the time you've travelled 30% of your available takeoff distance.

## Approach and Landing

You'll want to be stabilized on final approach with full flaps at 1.3 times the stalling speed in landing configuration. Don't cut your final short. Make it long enough to be stable and go around if you're unstable.

## Resources

Aircraft Weight and Balance Handbook – Chapter Six  
[www.faa.gov/regulations\\_policies/handbooks\\_manuals/aircraft/media/faa-h-8083-1a.pdf](http://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/media/faa-h-8083-1a.pdf)

